Modeling and Observations of the Response of Tropical Tropospheric Ozone to ENSO

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The El Nino-Southern Oscillation (ENSO) is the dominant mode of tropical variability on interannual time scales. ENSO appears to extend its influence into the chemical composition of the tropical troposphere. Recent results have revealed an ENSO induced wave-1 anomaly in observed tropical tropospheric column ozone. This results in a dipole over the western and eastern tropical Pacific, whereby differencing the two regions produces an ozone anomaly with an extremely high correlation to the Nino 3.4 Index.

We have successfully reproduced this result using the Goddard Earth Observing System Version 5 (GEOS-5) general circulation model coupled to a comprehensive stratospheric and tropospheric chemical mechanism forced with observed sea surface temperatures over the past 25 years. An examination of the modeled ozone field reveals the vertical contributions of tropospheric ozone to the column over the western and eastern Pacific region. We will show targeted comparisons with SHADOZ ozonesondes over these regions to provide insight into the vertical structure. Also, comparisons with NASA's Aura satellite Microwave Limb Sounder (MLS) and Tropospheric Emissions Spectrometer (TES) instruments and other appropriate data sets will be shown. In addition, the water vapor response to ENSO will be compared to help illuminate its role relative to dynamics in impacting ozone concentrations. These results indicate that the tropospheric ozone response to ENSO is potentially a very useful chemistry-climate diagnostic and should be considered in future modeling assessments.